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THE ARREST OF
GROWTH IN FOUR CASES OF CANCER

BY A

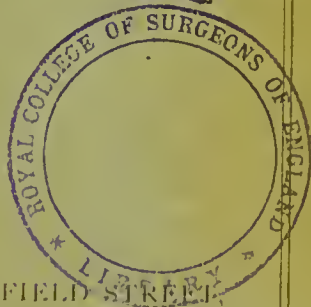
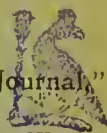
Powerful Interrupted Voltaic Current.

BY

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Reprinted for the Author from the "British Medical Journal,"
April 27, 1889.

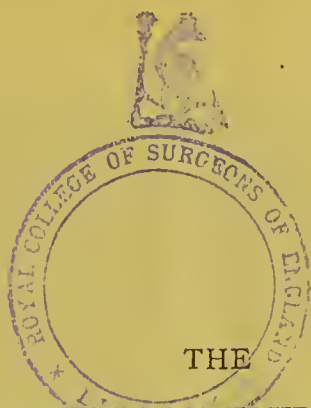


London :

JOHN BALE & SONS, 87-89, GREAT TITCHFIELD STREET,
OXFORD STREET, W.

1889.





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Powerful Interrupted Voltaic Current.

IT may be said that I am premature in bringing these cases forward. The paucity of clinical material at my disposal must be my excuse. I might have to wait some time before again obtaining suitable cases for testing the principles brought forward.

The only patients that I have had an opportunity of treating have been those who were beyond operative interference, or too nervous to undergo an operation with the knife.

The method of treatment about to be described is based upon the following considerations :

First, with regard to the nature of cancer. The earliest pathologists regarded it as a dyscrasia, or altered constitution of the blood ; then followed the embryonic cell theory ; finally, the microbe was made to bear the burden of further misdeeds.

Virchow, with his dogma, "*Omnis cellula e cellula*," demolished the first. The second, propounded chiefly by Cohnheim, will not account for all tumours, even if it be admitted as possible that embryonic tissue can remain for a quarter to half a century in the human tissues, without partaking in the changes undergone by other cells in the body. Thirdly, all attempts to find the microbe have failed.

The hypothesis now brought forward is founded on the fact that all the cells of the body possess a latent capacity which enables them, under various stimuli, to proliferate and form new tissue. Under normal conditions, this

capacity remains dormant, or is only exercised to the extent of keeping pre-existing structures in a living condition. But let an injury or irritation to some part of the body occur, and this latent capacity ceases to be dormant, and an active formation of cells takes place, until the injury is repaired or the irritation removed. Now this formation of new tissue is essentially a new growth, although not a tumour. The capacity for forming it is common to all the tissues of the body, and it ceases when the necessity for its continuance has disappeared. This appears to show some controlling influence, probably by the nervous system. Is it not, then, possible that all tumours are in the first instance composed of cells formed in the normal process of repair, but that, having escaped from the control of the nervous system, they take an independent life, and continue to proliferate and develop without check, just as all living cells are capable of doing *ad infinitum* under favourable conditions?

The frequent association of cancer with a depressed condition of the nervous system is explained by this hypothesis. In other words, a tumour consists of cells which have sprung from the pre-existing cells of the body, but have escaped from the control of the system at large. The failure of even Vichow to find any reliable histological evidence in the early stages of a recent celebrated case points to the probability that the boundary line between the tumour new growth in its early stages and a normal new growth produced in the repair of an injury to the tissues is very indefinite. The close connection between the two is shown by some statistics in a recent paper by Dr. Gross,¹ who found that out of some 907 cases of cancer of the breast there had been antecedent inflammation in 20 per cent., and a history of injury in 13 per cent.

Dr. John Williams found microscopical evidence of the gradual transition from healthy tissue into cancer in a case described by him in the Harveian Lectures.² At the same time, although devoid of nerves, all tumours have some sort of vascular arrangement, and continue to receive nourishment from the circulation. In this respect they are on an equal footing with the rest of the body. This appears to form a formidable barrier to any measures taken to stop growth through the internal administration of drugs.

¹ *International Journal of Medical Science*, March and April, 1888.

² 1886 ; Case xv., p. 51.

Whatever would affect the tumour cells would also affect all the cells in the body. Considering their origin and the similarity in composition between the cells of tumours and those of the rest of the body, it is unlikely that any drug will be found to exercise a selective influence on the former and leave the latter untouched. Unless this could be done, it would be necessary to damage more or less the whole of the body in order to get at the cancer cells.

There is one point, however, in which the normal cells of the body essentially differ from tumour cells. Most of the latter show a decided tendency to degenerate, while, in marked contrast to this, the healthy tissues possess wonderful recuperative powers, due probably to the presence of trophic nerves. It therefore seemed to me that if a cure were to be found for cancer it would be based upon this essential difference between healthy tissue and tumours, and that on account of this difference some agent might be found capable of inflicting an irreparable damage to a tumour, and yet stop short of destroying the normal cells of the body, on account of the higher recuperative powers possessed by the latter. And further, that, although the normal cells of the body are unable to resist the invasion of the cancer cells, the latter are actually of lower vitality. If such be the case, it may be asked why should the cancer cells devour the healthy?

The probability is, that the difference in composition and structure between the malignant and healthy cells is not sufficient to stimulate the latter to resistance. Consequently, the proliferation of the cancer cells, resulting from their independent existence, enables them to overcome the healthy cells, since these, for want of sufficient stimulus, remain passive. In a paper read before the British Gynaecological Society in 1888 "On the Action of the Constant Current on Fibroid Tumours of the Uterus," I advanced the following hypothesis: "That while the normal tissues of the body have the power of recuperating any effect produced on them by the transport of elements, the cells of tumours being of lower vitality might be checked in their growth, and perhaps in time destroyed."

The following experiments were tried in 1887 to ascertain whether, when a current is passed through a tumour, any decomposition takes place between the poles. Three glasses were connected together with a stout lamp wick. Into each of these a standard solution of iodide of potash was placed.

A current was then passed through the solution with an intensity of 200 milliampères until the whole of the iodide of potash in the two outer glasses was decomposed. On testing the centre glass, it was found to contain as much iodide of potash as before, although in the two outer glasses it was all decomposed. The resistance of this apparatus was so great that I was obliged to go to the Electric Apparatus Company, and do the experiment in the vaults of the Junior United Service Club, where an unlimited supply of volts could be obtained. A second experiment was then tried with water in the outer glasses and a solution of iodide of potash in the centre. The current was passed as before, but no decomposition took place in the centre glass. A third experiment was tried on the web of the frog's foot, and watched through the microscope. At the positive pole a coagulation took place, with exudation of blood from the capillaries. At the negative pole a collection of hydrogen bubbles could be seen. Between the poles no change could be observed, and the circulation went on as before. Finally, a strong current was passed through a fibroid tumour, soon after removal from the body, for a period of several hours. On making sections of the portion between the poles, no change could be detected. All these experiments demonstrated in a conclusive way that the passage of a constant current does not cause any decomposition between the poles, although there must of necessity be an exchange of atoms between the molecules. Recently, I have had an opportunity of examining sections of a fibroid tumour that I had thoroughly treated with a constant current, and which was subsequently removed by Dr. Travers on account of its size. No change could be found between the poles, showing that the conclusions drawn from the previous experiments were correct. Subsequent experience has shown me that repeated applications of the constant current, with an intensity of 200 milliampères, is unable to control the increase of a quickly-growing fibro-cystic tumour. But I noticed, in treating cases of fibro-myomata of the uterus by a constant current, that when, as occasionally happens, through an imperfection of the circuit, the current was suddenly interrupted, marked signs of disturbance followed, such as rise of temperature, considerable pain, and *malaise*. Rightly or wrongly, I put this down to some destruction of tissue occurring in the tumour, and, if this conclusion were correct, the means

required for the treatment of cancer on the hypothesis advanced has been found.

The most probable explanation of this phenomenon is that the impact of a powerful current, when suddenly flashed through, causes death to those tumour cells which lie in the nearest path between the poles where the lines of force are most concentrated, or else they are sufficiently injured to lead to their gradual atrophy. The latter explanation is more probably the true one, as no rise of temperature or other symptom follows the applications when applied to cancer.

Further than this, it has been ascertained by experiments on animals that even moderate voltaic currents suddenly interrupted could, when applied to the nervous system, cause death; while very much stronger currents applied to other parts of the body were found to be quite harmless in their action. If the normal cells of the body then differed so widely in their resisting power to electricity, it seemed more than likely that some difference would also be found between normal cells and those of tumours, although at first one might think the excess of resistance would be on the wrong side. For the treatment of fibroid tumours, anything likely to cause their wholesale destruction is to be deprecated. For this reason interruptions of the constant current have been carefully avoided, and precautions taken to gradually increase it as smoothly as possible. Being surrounded by a capsule, and having but few vessels in their interior, a gangrene *en masse* might follow, with all its attendant consequences. But this argument would not apply to cancer. Those cells especially that most require to be destroyed are scattered through the healthy tissues, and each little islet or bird's nest is surrounded by this tissue, furnished with vessels and lymphatics capable of absorbing it so soon as loss of vitality and degeneration occur. I therefore felt no hesitation in trying the destructive effects of a powerful interrupted voltaic current in the first case of cancer that objected to be operated upon in the usual way. After waiting a year or more the case presented itself. There is one point that, for want of space, I have not entered upon: Is cancer a local or a general disease? So far the accumulation of evidence appears strongly in favour of its being, at any rate, a local disease at first.

The *modus operandi* is as follows: The patient is anæsthe-

tised; the current is then passed through the tumour and all the tissues for some inches round it by means of fine, insulated needles, so as not to injure the skin. A battery of 70 cells, with an electro-motive force of 105 volts, is used; the intensity of the current to commence with is 10 milliampères, gradually increased to 600 milliampères, and flashed through the growth in every direction from 50 to 100 times, according to circumstances. The pulse and respiration are carefully watched. One out of the four cases treated, a woman aged sixty-three, with extensive carcinoma of the left breast, a presystolic *bruit*, and weak, intermittent pulse, was unable to stand more than 250 milliampères, and for this reason: when the current is applied to the left breast electrical stimulation of the heart occurs, and if this organ is healthy an increase in the strength of its contraction appears to take place after its passage; but with the patient who had cardiac disease the improvement only continued up to a certain point, and then the intermittency increased, and great irregularity occurred.

These observations made last year on the human subject corroborate exactly those made in the laboratory on mammals by Dr. John McWilliam, and described in a recent paper in the *Journal*. He called the condition of the heart fibrillar contraction, that is to say, a widely incoordinated arrhythmic contraction of the ventricular muscle, attended by a great and rapid fall of blood-pressure. It is only, however, in the immediate neighbourhood of the heart, and when it is diseased, that this takes place. When the current was passed through a secondary growth in the axilla of the same patient, it could be increased to 600 milliampères with perfect safety.

The effects produced by the action of the electricity consist in a cessation of growth, gradual disappearance of pain, some shrinking and hardening of the tumour and enlarged glands, followed by improved nutrition and better state of the general health. The growth as a whole does not disappear, but remains as an inert mass, composed in all probability of fibrous tissue alone. Before treating these cases I felt almost sure that this would be the case, because I had found by a number of experiments, detailed in the paper before referred to, and also from treating a large pelvic fibroma by galvano-puncture in 1887, that neither could electricity decompose the fibrous tissue of

new growths (whatever it might do with cicatricial tissue), nor could the system cause its absorption after it had been rendered inert. However, it will always be open to patients to have the remains of the growth removed subsequently by the knife. The advantages claimed for this method of treatment are as follows:—

1. There is no destruction to the normal tissues of the body, and if recurrence should at any time occur, its progress can be immediately stopped, and the treatment repeated as many times as necessary. Life would by this means be prolonged indefinitely, provided that metastatic deposits had not occurred before the commencement of the treatment. So far, cases able to bear the full strength required have shown no signs of recurrence.

2. Patients are not obliged to lie up, but are able to get about on the day following the application.

3. The current can be passed through almost any part of the body, and thus arrest growths which could not by any possibility be otherwise treated.

CASE 1.—August 15th, 1888. A. L., aged 38, married. Family: four children ; three miscarriages ; last, three years ago.

Family History : Mother died from asthma ; father, alive and well, aged 64. No history of cancer in the family.

Previous History : Has never at any time had any abscess or swelling in the breast, nor had any difficulty in nursing. Seven months ago she suffered from shooting pains in the left breast, and then noticed a lump there for the first time.

Present Condition : On the inner side of the left breast is a hard nodule, the size of a walnut, and a second one three times the size on the outer side, infiltrating the surrounding tissue. On the skin of the areola a distinct tuber can be seen ; the nipple is also retracted. In the axilla are three enlarged glands. She complains of shooting pains in the breast and down the arm.

Diagnosis : Carcinoma of the breast. Mr. Bryant very kindly saw this case for me, and confirmed the diagnosis.

August 23rd. Operation : Ether was given, and an interrupted voltaic current, slowly raised to 400 milliamperes, was applied to the breast and tissue round in every direction. During the application the pulse became stronger, while respiration was not affected. At each make and break, the arm and shoulder were jerked up.

August 25th. No rise of temperature or discomfort fol-

lowed beyond a slight feeling of *malaise*. The pain has all gone.

August 30th. Operation repeated.

September 15th. The glands in the axilla treated in a similar way, and she was sent home.

October 18th. No return of pain. The mass in the breast and the glands in the axilla are smaller and harder.

February 6th, 1889. She still has no pain, and the condition of the growth remains unaltered. General condition excellent.

March 12th. Patient continues to be quite well.

CASE II.—September 26th, 1888. S. H., aged 62, married. Family : three children.

Previous History : She never had any trouble or pain in her breasts until twelve months ago, when she noticed two small lumps on the left side. These gradually enlarged, and caused severe shooting pains. About four months ago she began to feel a dull aching pain in the shoulder, and extending down the left arm.

Present Condition : There is a large, hard mass involving the whole of the left breast, and extending on the subcutaneous tissue on the outer side, and towards the axilla. On the outer side of the breast the skin is adherent and thrown in wrinkles. The nipple is markedly retracted, and two tubers can be seen on the skin. The whole mass is firmly adherent to the pectoralis major, but not to the ribs. High up on the inner side of the axilla is an enlarged gland the size of a walnut. There is loss of sensation on the outer side of the arm; one of the supraclavicular glands is slightly enlarged. The pulse is irregular, weak, and intermittent. A presystolic *bruit* can be heard.

Diagnosis : Carcinoma of the breast, also confirmed by Mr. Bryant.

October 4th. Under ether, interrupted voltaic current, gradually raised to 300 milliamperes, was applied to the under part of growth. Any attempt to exceed this strength caused great irregularity of the cardiac beat. After thirty interruptions of the current it was necessary to desist, on account of the weak action of the heart.

October 10th. Same treatment was repeated to the rest of the growth, with the same limitations as before.

October 25th. The gland in the axilla was treated, and, as the pulse was not affected, the current was raised to 500 milliamperes. The patient went home next day.

November 7th. Pain in the shoulder and arm have quite disappeared, while sensation in the other part of the arm, which she had previously lost, has now come back ; but on the outer side of the breast, where considerable shrinkage has taken place, she still feels some pain.

December 19th. Condition unchanged. No pain, no sign of recurrence.

February 1st, 1889. The last few weeks she has had a return of the old pain. There is some redness and further infiltration of the skin near the nipple, and also some puffiness and œdematous swelling on the inner side of the growth. The mass as a whole is still movable, and does not appear larger, except for the puffiness before mentioned. But the swelling in the axilla, where the whole force of the battery was used, remains unchanged, nor is there any return of pain in the shoulder or arm.

February 2nd. Interrupted voltaic current, slowly raised to 400 milliampères, was applied to the whole of the upper and outer parts of the breast. The patient was then sent home.

CASE III.—November 12th, 1888. (Kindly sent to me by Dr. Gerald Harper.) E. E., aged 36, married. Family: eleven children, no miscarriages ; last child seven months. Menstruation always regular, quantity moderate, duration four days.

Previous History : Enjoyed very good health until after birth of last child seven months ago, when metrorrhagia began and has continued up to the present date. During this time it has never stopped for more than two days. Three months ago slight pains began, chiefly in the groins and back, extending down the thighs. These have recently become very much worse, and often keep her awake at night. The bladder during the same time has become very irritable ; she is unable to hold her water for more than an hour.

Family History : No history of cancer ; one sister died of consumption.

Present Condition : She is rather a pale, delicate-looking woman. Examination *per vaginam*: In place of the cervix there is a large excavated ulcer, in the shape of a hollow cone, extending for a short distance all round into the vaginal wall. The surface feels soft and irregular and bleeds profusely. The discharge is most offensive, and the odour can be detected some yards off. The broad ligaments on both sides are infiltrated, and the uterus is partially fixed.

Diagnosis: cancer, confirmed by Drs. Arthur W. Edis, Travers, and Gerald Harper. On consultation, the case is considered beyond operation.

November 18th. Ether administered. Interrupted voltaic current, applied to the growth. Intensity 400 milliamperes.

December 10th. She had no discomfort from the application. Ulcer is harder; still bleeds easily.

Ether administered. Interrupted voltaic current, 600 milliamperes, applied to every part of the growth and tissues round. To return home.

March 9th. After going home she was for some weeks in bed; the hæmorrhage, however, gradually went off, and she has had none for a fortnight. The last occasion she thinks was her period. She now has no trouble with the bladder nor has she lost flesh, and she is able to get about her house and do some work. She still feels some pain in the groins, but it is very much less.

On examination, the uterus is freely movable, and there is no infiltration of the surrounding tissues. The cup-shaped depression formed by the remains of the growth is very hard, but does not bleed at all on being touched.

Case IV.—January 15th, 1889. M. W., aged 61 (kindly sent to me by Dr. Potter, of Kensington Infirmary). Family: five children, no miscarriages; last child 14 years.

Past History: Two years ago she had a lump taken out of the upper part of the right breast at the Cancer Hospital. It recurred in twelve months' time and has continued to grow since. She suffered no pain, or very little, from it.

Present Condition: At the upper part of the right breast there is a small, hard, nodular mass, about 2 inches long and 1 inch broad. The skin over it is movable, but not freely so; it is attached to the pectoralis major and surrounding tissues, but it is not adherent to the ribs. There is no enlargement of the axillary or other glands.

January 18th, 1889. Interrupted voltaic current was applied to the growth, strength 600 milliamperes.

January 20th. Patient has experienced no pain or other ill effect from the current, and can go home.

March 12th. The growth appears to have shrunk, and she has no pain and no enlarged glands.

April 9th. Patient continues quite well; no signs of growth recurring.

REMARKS.—Case I. Although this patient up to the

beginning of March, eight months after the first application showed no signs of recurrence it is, of course, possible that this may occur, because I did not at that time feel sufficiently sure of my ground to increase the current beyond 400 milliamperes. With the second patient, who has heart disease, the quiescent state of the nodule in the axilla ever since it was first treated, six months ago, with full force of 600 milliamperes, compared with the renewal of activity in the older portion of the growth in the breast, where it was only possible to use 300 milliamperes, is very striking, because, as a rule, at this stage of the disease the growth is usually most virulent and active in the secondary formations.

The advanced stage in which Case III. was taken in hand gave very little hope of a successful result. Notwithstanding this, the patient at the end of three months is wonderfully improved, and able to go about and do her work. It seemed more than probable that as the patient was beyond surgical interference there would be some involvement of the lumbar glands which would be most difficult to get at, and, therefore, the possibility of metastatic deposits in this case must not be overlooked.

With regard to Case IV., the small size of the growth and the absence of any enlarged glands, and the capacity of the patient to stand the full force of the current required give every hope of a successful issue.

I feel very little doubt that some patients will be able to stand even a stronger current than 600 milliamperes, which is the maximum at present obtained. If recurrence occurs, I should feel no hesitation in increasing the intensity beyond that point. It may be said that cases of scirrhous are only slow growing, but with Cases I. and II. the previous history of so short a time as six months and twelve months respectively shows that, on the contrary, the growth has been remarkably active.





